WHAT IS CLAIMED IS:

1. A method of manufacturing a semiconductor device, comprising:

a step of forming a semiconductor layer of a second conductivity type on a semiconductor substrate of a first conductivity type;

a step of introducing an impurity in the semiconductor layer of the second conductivity type;

a step of forming a trench that pierces the semiconductor layer of the second conductivity type to reach the semiconductor substrate of the first conductivity type;

a step of forming an insulating film on a surface of the semiconductor substrate of the first conductivity type, on a surface of the semiconductor layer of the second conductivity type, and on side walls and bottom of the trench;

a step of forming a gate electrode in the trench; and

a step of forming a heavily doped layer of the first conductivity type in the semiconductor layer of the second conductivity type.

2. A method of manufacturing a semiconductor device according to Claim 1, wherein the impurity introduced in the semiconductor layer of the second conductivity type which is formed on the semiconductor substrate of the first conductivity type is an

impurity of a first conductivity type.

3. A method of manufacturing a semiconductor device according to Claim 2, wherein the impurity of the first conductivity type introduced in the semiconductor layer of the second conductivity type which is formed on the semiconductor substrate of the first conductivity type is arsenic or phosphorus.

4. A method of manufacturing a semiconductor device according to Claim 1, wherein the impurity introduced in the semiconductor layer of the second conductivity type which is formed on the semiconductor substrate of the first conductivity type is an inert element.

5. A method of manufacturing a semiconductor device according to Claim 2, wherein the impurity of the first conductivity type introduced in the semiconductor layer of the second conductivity type which is formed on the semiconductor substrate of the first conductivity type is argon.

6. A method of manufacturing a semiconductor device according to Claim 1, wherein ion implantation is employed in the step of introducing an impurity in the semiconductor layer of the second conductivity type which is formed on the semiconductor substrate

of the first conductivity type.

7. A method of manufacturing a semiconductor device according to Claim 3, wherein the impurity is introduced in the semiconductor layer of the second conductivity type which is formed on the semiconductor substrate of the first conductivity type in a concentration of 1×10^{17} atoms/cm^3 to 1×10^{18} atoms/cm^3.

8. A method of manufacturing a semiconductor device according to Claim 5, wherein the inert element is introduced in the semiconductor layer of the second conductivity type which is formed on the semiconductor substrate of the first conductivity type in a concentration of 5×10^{17} atoms/cm^3 to 1×10^{18} atoms/cm^3.

9. A method of manufacturing a semiconductor device according to Claim 1, wherein thermal oxidation is employed in the step of forming an insulating film on a surface of the semiconductor substrate of the first conductivity type, on a surface of the semiconductor layer of the second conductivity type, and on side walls and bottom of the trench.

10. A method of manufacturing a semiconductor device according to Claim 2, wherein the impurity is introduced in the semiconductor layer of the second conductivity type which is formed on the semiconductor substrate of the first conductivity type in a concentration of 1×10^{17} atoms/cm^3 to 1×10^{18} atoms/cm^3.

11. A method of manufacturing a semiconductor device according to Claim 1, wherein the impurity is introduced in the semiconductor layer of the second conductivity type which is formed on the semiconductor substrate of the first conductivity type in a concentration of 1×10^{17} atoms/cm^3 to 1×10^{18} atoms/cm^3.

12. A method of manufacturing a semiconductor device according to Claim 4, wherein the inert element is introduced in the semiconductor layer of the second conductivity type which is formed on the semiconductor substrate of the first conductivity type in a concentration of 5×10^{17} atoms/cm^3 to 1×10^{18} atoms/cm^3.

13. A method of manufacturing a semiconductor device according to Claim 1, wherein the inert element is introduced in the semiconductor layer of the second conductivity type which is formed on the semiconductor substrate of the first conductivity type in a concentration of 5×10^{17} atoms/cm^3 to 1×10^{18} atoms/cm^3.